Vol. No. 6 September 20, 1947

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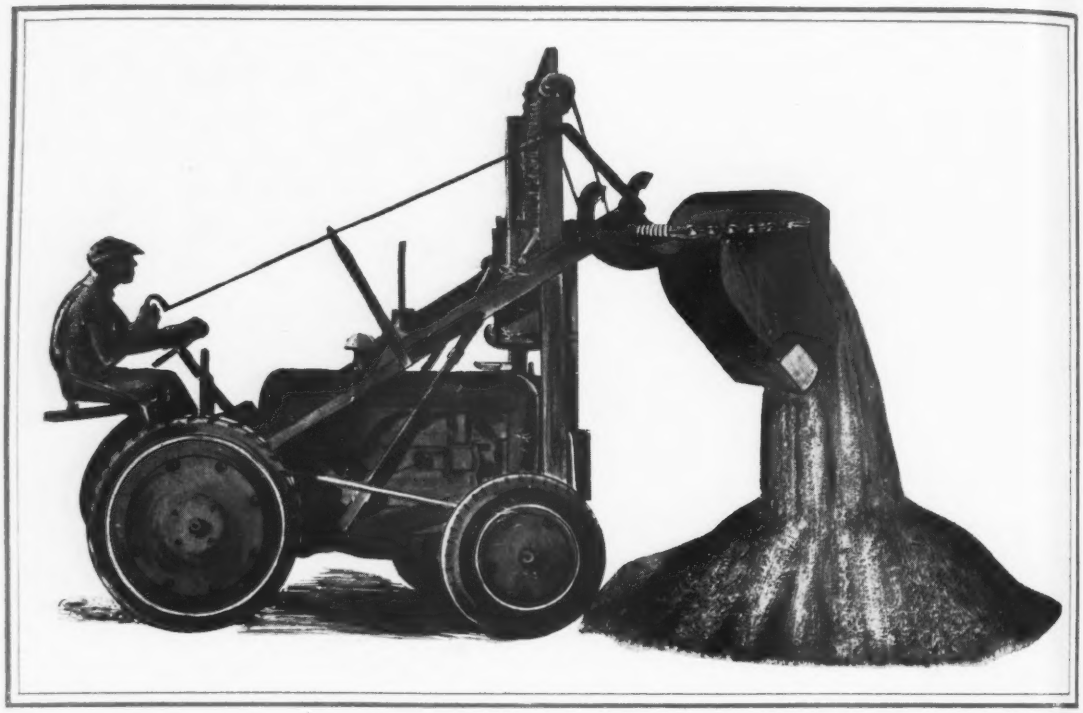

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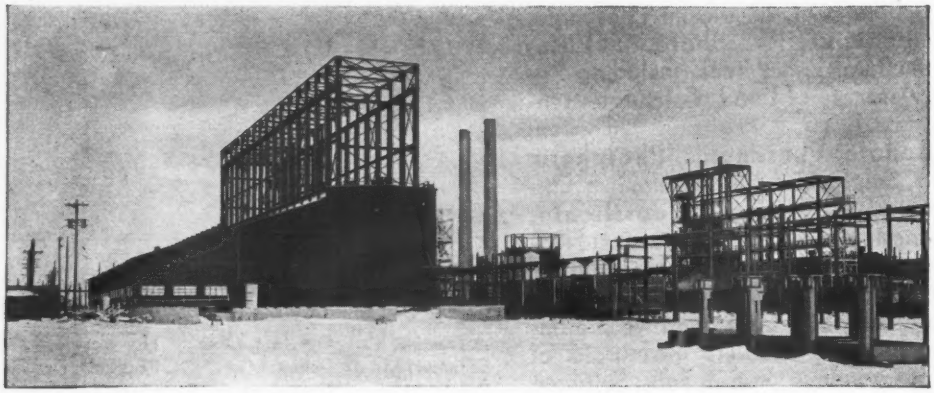

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The American FERTILIZER

Vol. 107 SEPTEMBER 20, 1947 No. 6

The Atom Goes To Work for the Farmer

Radioisotopes Serve To Develop More Efficient Methods of Fertilization

By VINCENT SAUCHELLI*

Chairman, Phosphate Research Committee

ABOUT a year ago a woman walked into a hospital in San Francisco, told of a lump in her breast and asked if it was cancer. The doctors injected a small amount of radioactive phosphorus into her veins, waited two hours, and then passed a Geiger counter over her body. Near her normal breast, and near her arms, legs and abdomen, the counter made a series of sharp clicks. When it came near the suspected breast the counter clicked like a machine gun. The lump was removed. The surgeons determined it was cancer. A simple, rapid and accurate diagnosis. Rapidly growing cancer cells take up more phosphorus than normal healthy cells. The Geiger counter measured the heavier concentration in the lump. The rest was easy.

Interesting, but what has this to do with the atom working for the farmer? Phosphorous metabolism in cancer cells may seem to be a far cry from phosphorus activity in a cotton or potato crop, but, actually, is it? Science is truly a "one world." Fundamental principles discovered in one field find an unexpected application in another field of knowledge. Because of the spectacular drama and tragedy at Hiroshima we associate the atomic bomb with the terror and destruction of the last World War, forgetting that the bomb was in fact the end-result of seventy-five years of brilliant research into the physics and chemistry of matter, and that the basic principles of those sciences also have their peacetime uses for mankind's benefit.

*Director of Agricultural Research, The Davison Chemical Corporation, Baltimore, Md.

Radioactive Phosphorus Research Committee

The radioactive phosphorus tracer used by the physicians in that San Francisco hospital is the same element now being used by agricultural scientists for developing more efficient and economical methods for the feeding of the Nation's crops and livestock.

In September, 1946, a group of men representing the fertilizer industry met in Washington, D. C., and from its membership organized the Phosphate Research Committee. With funds contributed voluntarily by a large number of companies in the fertilizer industry, they set up a project, to be administered jointly by the University of North Carolina, Cornell University, and the U. S. Department of Agriculture. The administrative leadership of the project is being carried by Dr. Ralph W. Cummings for the North Carolina Agricultural Station, Dr. Michael Peech for the Cornell Agricultural Station, and Dr. F. W. Parker for the Division of Soils and Fertilizer of the Bureau Plant Industry, U. S. D. A. The technical leadership is being carried by Dr. Lyman A. Dean and Dr. Sterling B. Hendricks, also of the

Bureau of Plant Industry at Beltsville, Md. The writer is chairman of the Phosphate Research Committee.

During the past year the project has had the full-time services of five scientists and the part-time work of at least ten others. Laboratory, greenhouse and field studies with various types of soils, fertilizers, and crops have been initiated. The first year's results justify the great hopes placed in the radioactive tracer technique as a method in solving many difficult problems in the utilization of fertilizers.

The Potato Crop Wants Fresh Phosphorus

Chemical analysis of soils of some of the old, heavy phosphorus-using sections of the country, especially those along the Atlantic seaboard, has revealed accumulations of large amounts of available phosphorus. Down in the commercial white-potato areas of North Carolina the State agronomists set up field experiments to see if less phosphorus might be applied without lowering yields. The study brought out that profitable and significant responses were given by the applied phosphorus each year on soils already containing high amounts of phosphorus.

Maine potato growers found the same response, on soils in Aroostock County which had accumulated heavy reserves of phosphorus.

The results were hard to understand. Of course, chemical analysis could not determine how much of the phosphorus absorbed by the plant was furnished by the soil reserves and how much by the applied fertilizer. Hence, the results reported by the agronomist could never give a completely satisfactory answer. There was always a doubt regarding the source of the phosphorus absorbed by a crop.

The radioactive tracer technique removes the doubt. We now can get a definite, satisfying answer.

The scientists at Beltsville, Md., working on the radioactive phosphate project previously described, investigated this phosphorus problem on a potato soil of North Carolina. The answer, neat, precise and clear-cut, was that the potato crop—tubers and plant—absorbs more than half its phosphorus requirements from the freshly applied fertilizer phosphate. Fig. 2 summarizes the data.

Radioactivity a New World

Because of the widespread publicity given to radioactive research in all branches of science, we have received many requests from farmers and other laymen for a simplified explanation of the concepts and definitions used in discussions on radioactivity.

To the layman much of the writing on atomic energy and radioisotopes is confusing because it deals with a subject far from his ordinary experiences and the jargon used by the writers bewilders him. He is aware that here is something that concerns him vitally and he should be familiar with some of the basic concepts, yet it seems so difficult to understand.

It must be confessed that the subject is not easy to translate into everyday word usage. In what follows an attempt is made to present briefly and simply a few fundamental concepts of radioactivity. We shall then tell of some other applications of the tracer technique reported to the Phosphate Research Committee by the scientists at Beltsville, Md.

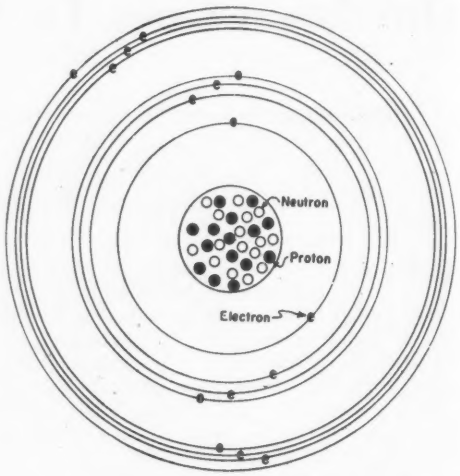

Fig. 1. Representation of a phosphorous atom, $_{15}P^{31}$

Prepared by U. S. D. A. Bur. Plant Industry, Div. Fert. Soils and Irrigation

Atomic Theory

We may as well begin at the beginning. Man has speculated from earliest times about what matter is made of. Is a piece of copper, say, made up of tiny, distinct particles of copper held together by certain attractive forces or is it like a piece of jelly which, no matter how much you divide it, is always identical and continuous throughout? To put it another way, would the copper under high magnification appear like a quart of peas or like jelly?

The atomic theory which is accepted by science today is the "quart of peas" theory.

This theory assumes that all matter is, in the final analysis, made up of tiny grains which are called atoms because they cannot be further divided.

The Atom

The modern concept of the atom is like that of our solar system. At the center or core of the atom is the positively charged nucleus around which, moving in a sort of fixed orbit or series of orbits, are its electrons. This is illustrated in Fig. 1.

An atom is so small in size it defies our comprehension. The barely visible particles of an element are in fact an aggregation of millions upon millions of atoms. The chemist deals with the behavior of infinitely large masses of atoms. If several million atoms should act contrary to the rest, their behavior is so small, relatively speaking, that it is rarely if ever noticed. For example, an analyst may precipitate phosphorus from solution and, in doing so, leave a billion phosphate ions behind. Their absence would not be detected, but if instead of common atoms he was dealing with atoms having radioisotopic phosphorus, 20 millions of these isotopes would be discharging 10 electrons every second. Such a number of disintegrations would be detectable with a counter. (Further along, you will find explanations of isotopes, common and radioactive.)

Hence, you can appreciate how, through the use of radioactive atoms, it is possible to consider the behavior of small populations of atoms which chemical analysis could never possibly detect.

The hydrogen arom is the lightest atom: it has one positive charge as its nucleus and only one electron satellite. The heaviest atom contains two hundred or so electrons, and weighs about 238 times more than the hydrogen atom.

For many years the atomic theory helped chemists build up their great science. It was assumed that atoms are the ultimate stuff of matter; that certain substances are simple and cannot by chemical means be built up of other substances; but that the great majority of substances are compounds. Thus, the solids like copper, silver, gold, iron, phosphorus are examples of the simple substances which cannot be built up by making substances combine to form them. Chemistry teaches that there are about 92 known simple elements. All known substances are built up of two or more of these elements. Thus, sugar is a compound built up of carbon, oxygen, and hydrogen; muriate of potash is built up of potassium and chlorine, and so on. In other words, all chemical compounds are formed by the atoms of different elements combining one with the other in definite proportions and in a multitude of permutations.

The Electrons, Protons, and Neutrons

The next important concept to consider is that of electricity.

Electricity is a form of energy composed of atoms of electricity. This conforms with the modern idea of the atomic nature of matter. There are positive and negative atoms of electricity. The atoms of pure negative electricity are called electrons; those of positive electricity, protons. The negative atoms can be obtained in many different ways. If a metal is heated to red heat it gives off electrons. You have this effect in your radio tube. When the wire in the tube is heated by the passage of electricity, that wire gives off a stream of electrons which is used to magnify the electrical broadcast wave.

The electron is a constituent part of the structure of all atoms. For each electron there must be present a positive charge to neutralize the negative charge of the electron. The atom itself has no free charge. The positive charge is found in the nucleus.

The mass of the atomic nucelus is made up of the sum of the masses of the protons and neutrons. A proton has the relative mass of 1 and is about 2,000 times heavier than an electron. A neutron is a proton without the positive charge. For convenience the nuclear mass is written as a superscript to the chemical symbol. Example, P^{31}. The positive charge of the nucleus is equal to the number of the protons and is indicated as a left subscript. Example, ${}_{15}P^{31}$.

All electrons are alike. Atoms differ, one from the other, in the number of electrons they can maintain as satellites. The statement of that number of satellites describes the atom completely insofar as its behavior toward other atoms is concerned. For example, the atom of carbon can hold 6 electrons: the positive charge on the nucleus is the counterpart of the 6 negative charges of its 6 electron satellites. Every atom which can retain 6 electrons is a carbon atom. For purposes of all identification any atom surrounded by 6 electrons is what in chemical language is called "carbon." No other definition of the carbon atom is needed. Similarly, any atom which has 7 attendant electrons identifies itself as a "nitrogen" atom. The 8-electron atom is oxygen. The characteristic of any particular sort of atom which never changes is the positive charge of electricity on its nucleus.

Isotopes: Radioisotopes

An isotope is an atomic twin with one distinguishing feature: it is different in weight. Twins may be alike in height, color of hair, and facial features, but differ in weight. This is true of isotopes. An isotope behaves chemically in the same identical manner as its twin. There are two kinds of isotopes, a normal, unchanging type like the one just described, and a radiant type.

Radioisotopes

A radioisotope is chemically identical with its normal twin, but differs in having the property of emitting radiant energy. It is therefore called a radioactive isotope. It is energetically unstable.

To change one element into another, it is only necessary to change the number of protons in the nucleus. In the early smashing of atoms by means of the cyclotron it was discovered that it was possible to knock neutrons into or out of the nucleus, with the result that a radioisotope of the ordinary element was produced.

Some radioisotopes are found in nature, such as radium, and thorium. Radioactivity is a form of disintegration or a symptom of decay. Eventually all radiation is dissipated. We say the atom then reaches stability. However, when that stage is reached the element is no longer the same element. For example, after a long period radium eventually reaches stability, but it is no longer radium: it is lead. The same lead you are familiar with in a lead pipe.

Although they are identical in chemical properties with their unchanging twins, radioisotopes, being radioactive, can be detected or traced by appropriate instruments. This feature is what makes them so extremely important. An infinitely small amount of such an isotope can be traced through an intricate chemical reaction involving a complete biological cycle in a plant, or animal, or human. The tracing is done by means of an instrument called a Geiger Counter. So long as there is a trace of radioactivity, the counter will detect it.

It would take too long to describe the counter. Suffice it to say that it is sensitive to the passage of electrons. A specially prepared tube registers when one of the charged particles strikes it. The electrical disturbance created by the particle is amplified within the tube so that it can be registered in the form of a click sound or can cause an instrument to register it mechanically on a dial. There are many types of counter, from the small portable kind to large, permanent laboratory installations.

Half-life

The rate at which the radioisotope disintegrates per second can be measured in much the same way one measures any other speed or rate, such as miles per hour or feet per second. Each radioisotope has a constant speed of disintegration, known as its "half-life." It is the length of time it takes the radioactivity to fall to one-half of the initial value. It can be compared to the length of time it takes the radioactivity to fall to one-half of the initial value. It can be compared

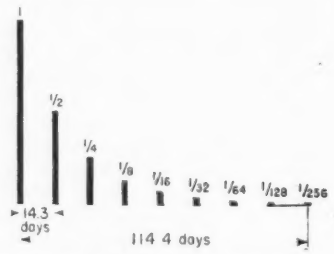

Fig. 2. Rate of decay of $_{15}P^{32}$

Prepared by U. S. D. A. Bur. Plant Industry, Div. Fert. Soils and Irrigation

to the length of time it takes an auto to slow down from 40 to 20 miles, 20 to 10, 10 to 5, 5 to 2.5, etc., miles per hour. Boron isotope has a half-life of 1/50 second; radiophosphorus 14.3 days; and carbon 14 isotope, about 5,000 years.

Isotopic Tracer Technique

With the foregoing information about the atom and isotopes as a foundation, it will be easier to understand a discussion of the isotopic tracer technique. The radioisotope has been compared to an atom that has been tagged, because it can easily be followed or traced by means of its radiation. The technique is simple, rapid and exceptionally accurate. You recall what was said about the millions of atoms engaged in chemical reactions. The minutest quantity of phosphorus isotope can be chemically introduced into a phosphate molecule. That molecule will behave chemically like any normal phosphate molecule. But since it contains the tagged phosphorus atom, that molecule can be detected by the Geiger counter throughout the chemical cycle in which it is involved.

(Continued on page 26)

Anhydrous Ammonia

Newcomer to the Field of the Mid-South*

By W. C. LASSETTER

Vice-President and Editor of *The Progressive Farmer*

IT IS estimated that more than 150,000 acres of crops in Mississippi, Arkansas, and possibly Louisiana will have been fertilized with anhydrous ammonia this year. More than 200 machines for its application are said to have been in use. Probably no other new farm practice has spread so quickly. The shortage of other forms of nitrogen fertilizers stimulated its acceptance. The low cost of nitrogen fertilizer in this form did nothing to retard it. More would have been used had the machinery for applying it been available.

The first research in the use of this product as a fertilizer in Mississippi was started by the experiment station about three or four years ago in cooperation with the Tennessee Valley Authority. Comparative tests of anhydrous ammonia and ammonium nitrate as sources of nitrogen for cotton were conducted at seven points in the state in 1945 and at six in 1946. A total of some 62 comparisons were made each year. Anhydrous ammonia proved to be fully as effective in increasing yields as was ammonium nitrate, in fact a bit more effective. The same was true in the case of corn. Comparative tests with oats proved variable depending on time of application and the acidity of the soil.

Anhydrous ammonia is ammonia without water. Under ordinary conditions it is a gas. Under high pressure it is a liquid. It is 82.3 per cent nitrogen. It has to be handled in tanks capable of withstanding high pressure, about 225 pounds to the square inch.

If gaseous ammonia was to be used as a fertilizer, how could it be applied? That was the first problem confronting the station men. But their engineers soon solved that. A high pressure tank was fitted on a tractor and equipped with the necessary safety valves. A tube was run down to the ground and into the ground just back of a knife-like device. The latter cuts a path for the tube to follow. With the valve open the liquid escapes into the tube. With the pressure released the liquid turns into gas. The tube feeds the gas into the soil to a depth of about six inches. A disk hiller right on its heels covers before the gas can escape.

The value of anhydrous ammonia as a fertilizer and the practical method of applying it were announced by the station in March. At that time none but the experimental machines were available. Fortunately this area had a great many flame cultivators. The tanks on these machines where propane was used, were suitable for anhydrous ammonia. Both require about the same pressure. Butane tanks would not do. They are not built to stand the pressure that propane tanks have to stand. Local mechanics made a quick job of converting propane tanks to the use of anhydrous ammonia. Then too, some local shops already experienced in the manufacture of flame cultivators found it easy to change over to the manufacture of machinery for applying anhydrous ammonia. Thus by the end of the fertilizing and sidedressing season more than 200 machines were in operation. We do not know the distribution of these among the three states, Mississippi, Arkansas, and Louisiana.

Planters of these states have applied anhydrous ammonia as a fertilizer for cotton in the following ways: (1) on level land, before planting, (2) on bedded land, before planting, (3) before planting and bedding simultaneously with listers, and (4) as a sidedressing. To date it has been tried on cotton, corn, and oats. All responded equally as well if not better than to ammonium nitrate except in the case of oats. There the acidity of the soil affected the results. Anhydrous ammonia, in the case of oats, gave better returns on the more acid soils, while ammonium nitrate did better on the less acid soils.

What happens to the ammonia? Properly applied, it goes into solution in the soil water, from which it combines with the clay. It does not leach out but it comes off the clay particles fast enough to supply crops with nitrogen.

(Continued on page 24)

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Committee to Recommend Shipping Regulations on Ammonium Nitrate

Major General Philip B. Fleming, administrator of the Federal Works Agency, will appoint a five-man committee to conduct an exhaustive study into the hazards in the storage and handling of ammonium nitrate aboard ships. The appointment of the committee was authorized at a conference of representatives of the chemical industry, insurance underwriters and officials in Federal, state and local agencies held in Washington on September 8th by the President's Committee on Fire Prevention.

The sum and substance of the gathering was that, despite the fact that the explosive character of this form of fertilizer has been known for a quarter of a century, there was still much to learn of the cause and conditions under which the material explodes. However, it appears to be the general consensus that with proper handling, proper storage so as to be free from contamination with organic substances, and with due regard to fire regulations, the material can be shipped safely.

In a formal regulation adopted unanimously, the committee to be appointed was authorized to give immediate consideration to the question of ammonium nitrate shipments from ports other than isolated ports; to the question of shipments from one port to another; the problem of containers for the fertilizer, and to support continuous and enlarged research into the subject of the causes of combustion and its control. General Fleming is to name the group at an early date. All the latest information available on the safe handling of ammonium nitrate in transport is to be printed by the committee and distributed generally.

The committee will coordinate its activities with those of the inter-agency committee studying the ammonium nitrate problem, recently organized by Secretary of the Treasury Snyder and headed by Admiral Joseph F. Farley, Commandant of the Coast Guard, which is also undertaking independent research on the problem.

The session was opened by General Fleming calling attention to the need for studies to reduce the danger of combustion of ammonium nitrate aboard ship, without imposing controls that would hamper the rapid shipment of this plant food to the stricken areas of the world desperately in need of fertilizer.

Among the fertilizer industry representa-

tives present were R. C. Charlton, The American Agricultural Chemical Company; Harold Haase, Ochoa Fertilizer Company; C. Clifton Howes, Davison Chemical Corporation; R. R. Hull, I. P. Thomas and Son Company; Maynard Jenkins, Spencer Chemical Company; A. F. Reed, Lion Oil Company; John C. Bennett, American Cyanamid Company; John L. Bennett, Hercules Powder Company; and Maurice H. Lockwood, President of The National Fertilizer Association. U. S. D. A. was represented by W. A. Minor, Assistant to the Secretary of Agriculture; Lewis G. Porter of the Production and Marketing Administration and by Dr. R. O. E. Davis of the Bureau of Plant Industry.

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Several speakers pointed out that in spite of the fact that more than one million tons of ammonium nitrate have been handled for fertilizer purposes during the past six years, no serious fires or explosions have occurred, except were carelessness was evidently to blame.

A Continuous Mixing Process for the Manufacture of Concentrated Superphosphate

A process for making concentrated or "triple" superphosphate by continuously mixing phosphate rock and phosphoric acid in a new type of mixer was described in a paper presented on September 17th, before the Fertilizer Division of the American Chemical Society at the Hotel Pennsylvania, New York City, by G. L. Bridger, R. A. Wilson, and R. B. Burt of the Tennessee Valley Authority, Wilson Dam, Alabama.

In the new process, strong phosphoric acid, made by the electric furnace smelting of phosphate rock, and finely pulverized phosphate rock are fed at automatically controlled rates into a funnel-shaped mixing bowl in such a way as to produce a whirlpool effect. The mixture is discharged from the bowl while still liquid onto a moving conveyor belt. After a few seconds it solidifies on the belt due to chemical reactions and is carried by mechanical conveyors to storage.

The process is based on the fact that when phosphate rock and strong phosphoric acid are mixed, a very fluid slurry is obtained for only a few seconds, after which the mixture becomes plastic and finally solid. In the batch-mixing process, used previously, it was not possbible to obtain thorough mixing and discharge the mixers while the mixture was still fluid. Consequently, the mixing operation was slower and required more equipment, power, and operators. In the new process it is possible to adjust conditions so that mixing is completed and the mixture discharged in the liquid state.

The new process is being used in TVA's Fertilizer Works at Wilson Dam to produce concentrated superphosphate at rates of 35 tons per hour and higher. A single small continuous-mixing unit has superseded two large batch-type mixers, and as a result there have been reductions in operating labor and power requirements. The initial cost of the new unit was considerably less than that of the older units. The superphosphate made by the new process is of better quality because more thorough mixing is accomplished.

Lockwood Answers Sabath

An investigation of the fertilizer industry, such as has been proposed by Rep. Sabath of Illinois, would show that fertilizer prices today are only 35 per cent above the 1935–39 average, as compared with an increase of more than 100 per cent in commodity prices generally, Maurice H. Lockwood, president of The National Fertilizer Association, stated recently.

"Government figures show that the increase in fertilizer prices over the pre-war level is substantially less than the increase in raw material and wage costs during the period," Mr. Lockwood said.

"Fertilizer is just about the cheapest commodity the farmer buys."

Monarch Mfg. Works Moves to New Plant

The Monarch Manufacturing Works, of Philadelphia, Pa., manufacturers of spray nozzles for acid chambers and other spray installations, is moving to a new and larger plant located at 2501 East Ontario St., Philadelphia 34, Pa. Operation of the new plant is expected to start about September 22nd.

Goals for 1948 Winter Cover Crop Seeds Announced

National goals calling for increased acreages of the principal winter cover crop seeds to be harvested in 1948 were announced on September 10th by the U. S. Department of Agriculture.

The 1948 goals (as compared with the 1947 acreages) call for a 48 per cent increase in the acreage of Austrian winter peas, a 30 per cent increase in crimson clover, a 39 per cent increase in hairy vetch, an 8 percent increase for common and Willamette vetch, and a decrease of 28 per cent for common rye grass. The goal for blue lupine is the same as this year's acreage.

Winter cover crop seed requirements are at a high level, a situation that is expected to continue for several years. The export market for these seeds has been considerably reduced but domestic use of cover crops is expanding. Agriculture Department officials say the use of these seeds should continue to increase so as to rehabilitate soils which have been heavily cropped during the last six years.

Following are the goal acreages for 1948 compared with indicated 1947 harvest acres:

	1948	1947
Austrian winter peas	74,000	50,000
Crimson clover	92,000	70,900
Hairy vetch	159,000	114,500
Common and Williamette vetch	90,000	83,500
Common rye grass	68000	94,000
Blue lupine	57,000	57,000

State goals for the 1948 crops will be announced following a determination of local possibilities by Federal and State agricultural agencies at State and county levels.

Taylor Joins American Potash Staff

American Potash & Chemical Corporation has just announced that Henry L. Taylor, Jr., has joined that company as of September 1st to become Manager of Midwestern Sales. Mr. Taylor will be located at the company's Chicago, Illinois, office, 231 South La Salle Street, Chicago 4, Illinois. He was formerly connected with the International Minerals & Chemical Corporation.

Henry L. Taylor, Jr.

FERTILIZER MATERIALS MARKET

NEW YORK

Materials Situation Still Extremely Tight. Increased Prices on Nitrogen Materials Reported. Feed Market More Active and Organics Increase in Price. Superphosphate Output at Top Peak with Further Increases Expected

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, September 15, 1947.

There is relatively little to report on developments during the last fortnight. Demand still continues greater than producers' estimated supplies. Materials plants are shipping to the limit of production and are about able to keep up with contract commitants without any chance of increasing allotments or advancing shipping schedules. The conference on ammonium nitrate shipping hazards did not attempt to reach any final conclusions on the subject but has arranged for further study of the problem. Meanwhile fertilizer manufacturers are taking all of this material that is available.

Sulphate of Ammonia

Prices have shown a tendency to reach a higher level, and now are running from $35.00 to $40.00 per ton, f. o. b. producing ovens. Quite a little of this material has been shipped on contracts at the $35.00 price but the increasing costs make it likely that later shipments will be at a higher range. Most schedules specify prices as current at time of each shipment.

Ammonium Nitrate

The price on Canadia ammonium nitrate has been increased to $62.75 per ton, f. o. b. works, in paper bags. The market is exceedingly tight on this material, both for home use and for export.

Organic Materials

The increasing demands of the feed have caused increases in most branches of the organic market. As high as $10.00 per unit of ammonia ($12.15 per unit N) is being asked for tankage. Dried blood has gone up 25 cents a unit, fish meal and scrap from $5 to $10 a ton.

Nitrate of Soda

Producers of domestic nitrate of soda have announced an increase of $5.00 per ton, effective October 1st. This brings the domestic material more on a line with the Chilean nitrate. The demand for nitrate of soda continues heavy, nevertheless, and producers and importers have no difficulty disposing of every available ton.

Superphosphate

With greater supplies of suphuric acid in sight, it looks as if supplies of superphosphate will continue to increase. One of the Ordnance acid works in Alabama is reported as being soon avaliable for fertilizer use which would add over 150,000 tons to the acid supply and permit the production of another 300,000 tons of superphosphate. Meanwhile, mixers are taking all available production as soon as it is in shape to ship.

Phosphate Rock

There has been no let-up in the demand for rock and the mining companies are shipping from current production. The output figures show that all records have been broken and, with new mining facilities coming into operation, the new fertilizer year should see even higher production.

Potash

The same condition of demand for exceeding production continues in the potash industry. Fertilizer producers have tried to increase their contract purchases but without success as the potash companies are sold up to their production limit. There have also been requests for advances in shipping dates, in anticipation of an earlier demand for mixed goods, but they are meeting with little success.

CHARLESTON

Record Tonnage of Mixed Fertilizer Expected. Organics Prices above Fertilizer Levels. Ammomonium Nitrate Price Adanced in Canada

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, September 13, 1947.

All prime ingredients continue short of demand but in spite of this situation it is expected the production of complete mixtures of fertilizers will be greater than ever before for the coming season.

Organics.—Little change is noted in the market on organics. South American packing-house by-products continue at prices higher than most domestic buyers will pay. Some European nitrogenous is offered but at figures around $8.25 per unit of ammonia ($10.02 per unit N) with little interest shown by the buyers. Domestic nitrogenous ranges in price from $5.25 to $6.50 per unit of ammonia ($6.38 to $7.90 per unit N) in bulk, depending on production point. However, offers for domestic nitrogenous are lacking in the market.

Castor Pomace.—Production is reported at low levels with prices firm and unchanged. Movement is against contract commitments.

Potash.—Nothing additional is being offered and demand continues far in excess of the supply.

Nitrate of Soda.—There remains a spread between prices for domestic and Chilean nitrate of soda but it is expected that domestic producers will eventually fall in line with the price of Chilean nitrate of soda.

Ammonium Nitrate.—Prices on Canadian material have advanced by about $8.25 per ton and the present market is around $62.75 per ton in paper bags, f. o. b. plant. It is reported that relatively little nitrate is being shipped abroad at the present time by the Government.

Dried Ground Blood.—Chicago price is around $7.50 to $8.00 ($9.12 to $9.72 per unit N) with little interest shown by fertilizer manufacturers at the higher level.

Bone Meal.—Some buying interest has been indicated by the fertilizer trade, but the price remains unchanged.

Superphosphate.—This material is particularly scarce in the southeast and demand continues strong.

Phosphate Rock.—The movement of phosphate rock continues curtailed by a shortage of box cars used in the movement of grain to the ports. The market is firm and demand is strong.

PHILADELPHIA

Demand for Future Delivery Greater Than Probable Production. Feed Demand Keeps Organic Prices High

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, September 15, 1947.

Interest in raw materials for future delivery continues quite active. Demand is principally for the basic chemicals, and while productions are well under contract, buyers would like to hasten shipment and also increase the quantities. Organics are in limited supply, and increased demand by stock food manufacturers keeps the prices too high for fertilizer use.

Sulphate of Ammonia.—Demand continues active and ahead of production, with price range from $35.00 to over $40.00 per ton in bulk. Most contracts are said to provide for fluctuation.

Nitrate of Soda.—Market is firm with interest mostly in future shipments.

Nitrate of Ammonia.—There is very active demand for this article, with supply insufficient to meet requirements. New shipping and handling regulations are presently under consideration.

Castor Pomace.—Production is said to be running low, with no first hand offerings reported.

Blood, Tankage, Bone.—Demand from the feeding trade is sufficiently active to keep these organics out of the fertilizer field. Blood has been offered at $7.50 to $8.00 per unit of ammonia ($9.12 to $9.72 per unit N), with tankage at $8.50 to $8.75 ($10.33 to $10.63 per unit N). Bone meal seems to be in better supply, with prices ranging from $52.50 to $65.00, according to quality.

Fish Scrap.—Fairly active interest. Scrap has been quoted at $120.00 and meal at $134.00 per ton for 60 per cent protein grade —all feeding business.

Phosphate Rock.—Production is moving on contracts, and the supply position is exceedingly tight. It is thought the output will be increased in the near future.

Superphosphate.—The demand continues strong, and while the production has increased, movement is principally on contracts. Producers show no eagerness to make further sales at present.

Potash.—Demand is very strong with shipments moving out of production. The requirements are now far ahead of the supply capacity.

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CHICAGO

Fertilizer Organics Sold up into Fall. Feed Feed Tankage Price Increased

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, September 13, 1947.

Offerings of mid-west organic fertilizer material are still lacking, sellers maintaining to be well sold for late fall deliveries. Some inquiry from buyers has again been manifested.

It is reported some of the large producers have advanced 60 per cent protein digester tankage up to $130.50 a ton. Demand apparently is greatly in excess of supplies, particularly for digester tankage, which latter is being sought by hog feeders.

Chase Bag Plant Receives Safety Award

In recognition of an outstanding safety record, the Liberty Mutual Insurance Company awarded the Dallas Branch of the Chase Bag Company a Certificate of Merit for safety achievements.

At a general meeting of all plant personnel, Castle Hopper, Plant Superintendent, accepted the award on behalf of the employees who accomplished nearly one quarter million man hours without an accident.

A. C. Ogden, Manager, expressed the company's appreciation to the employees for their accomplishment during the Chase Bag Company's Centennial year.

Sulphate of Ammonia During July

There was little change in by-product sulphate of ammonia production during July, according to the U. S. Bureau of Mines. The output of 66,018 tons was slightly less than that of June. Shipments increased slightly, while stocks on hand at the end of the month were only 26,229 tons. Until new coke ovens and recovery plants can come into production, the output will probably remain at this level.

	By-Product	
	Sulphate of Ammonia Tons	Ammonia Liquor Tons (NH_3)
Production		
July, 1947	66,018	2,382
June, 1947	66,168	2,263
July, 1946	64,864	2,158
Jan.-July, 1947	461,856	16,335
Jan.-July, 1946	331,359	13,546
Shipments		
July, 1947	62,050	2,326
June, 1947	61,917	2,260
July, 1946	42,766	1,855
Stocks on hand		
July 31, 1947	26,229	610
June 30, 1947	22,417	709
July 31, 1946	47,194	823

The U. S. Bureau of Census reports production of 18,397 tons of synthetic sulphate of ammonia, technical grade, during July. The output of synthetic anhydrous ammonia during July was 93,345 tons, while ammonia nitrate solutions totaled 87,253 tons.

Sugar Cane Responds to Complete Fertilizer

The old adage about "the more you put into something the more you get out of it" seems to apply to raising cane—that is, sugar cane. Complete mixed fertilizer gave better returns in Louisiana tests than applications of nitrogen alone.

The best adapted treatment in last summer's tests was a combination of 60 pounds of nitrogen with adequate quantities of phosphorus (P_2O_5) and potash (K_2O). This was the highest rate of nitrogen used in the tests.

Top increase in yield was obtained on a plot which received 60 pounds of nitrogen and 40 pounds of phosphorus. But in over-all yields,

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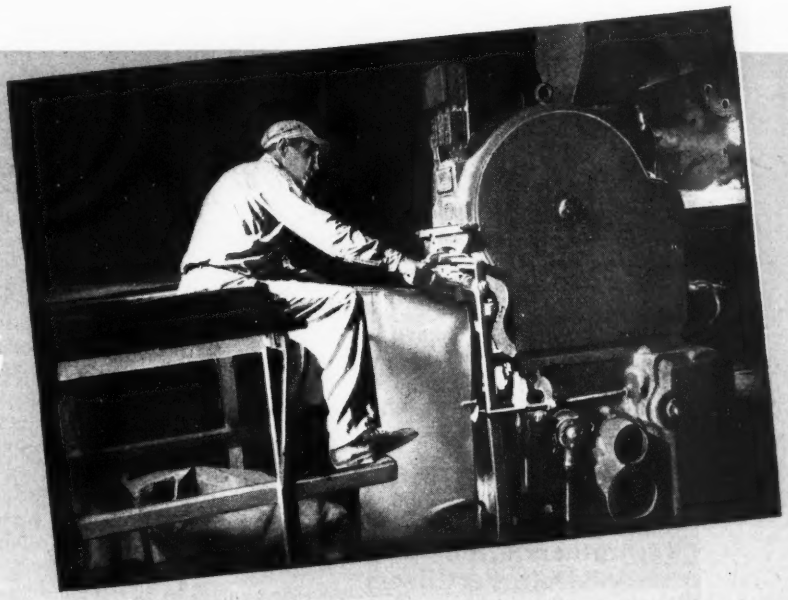

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the combination of the three elements gave best responses.

Levels of nitrogen used in the experiment ranged from 40 to 60 pounds, phosphorus (P_2O_5) from 25 to 60 pounds, and potash (K_2O) from 40 to 60 pounds. The combination which gave best results in the tests was 60 pounds of nitrogen, 25 pounds of phosphorus (P_2O_5), and 40 pounds of potash (K_2O).

The increase in yield from the combination of these amounts of plant food was 1,530 pounds of sugar per acre. The growing season was very wet and both plant and stubble cane responded profitably to nitrogen at the 60 pound per acre level.

In 1945, results from similar tests showed that the highest yields of sugar were obtained on the average from 60 pounds of nitrogen, 40 pounds of phosphorus (P_2O_5) and 60 pounds of potash (K_2O) per acre.

Last summer's tests were conducted by R. K. Walker and M. B. Sturgis of the Louisiana Experiment Station.

Recommendations for Georgia Grain Fertilizers

"Farmers who plant small grain should check up now on the availability of nitrogen for spring topdressing," urges J. G. Futral, associate agronomist at the Georgia Experiment Station.

The Station's general recommendation for grain is to apply all of the phosphate and potash in the fall at planting. Part of the nitrogen may be applied in the fall and the remainder in the spring, or all of it may be applied in the spring.

"Last year many farmers were unable to obtain nitrogen for spring topdressing," Mr. Futral says, "and this situation seems likely to occur again in 1948."

In order to cut down on the amounts of spring nitrogen needed, he suggests a complete fertilizer should be applied in the fall to furnish part of the nitrogen needed. Then smaller amounts of nitrogen than would normally be used may be applied in the spring.

Expressed as pounds of plant food, Mr. Futral recommends that grain should receive 32 pounds per acre of phosphate and 24 pounds per acre of potash. Oats and barley should receive a total of 32 pounds of nitrogen and wheat up to 48 pounds of nitrogen per acre. These amounts may be obtained by using 400 pounds per acre of a 4–8–6 fertilizer in the fall followed by a spring topdressing of 50 to 100 pounds per acre of any of the usual sources of nitrogen.

"If no nitrogen is available in the spring," Mr. Futral points out, "use a topdressing of 200 pounds per acre of complete fertilizer, preferably one containing at least six per cent nitrogen."

Cows Know Their Phosphates

Livestock on the farm of J. C. Pafford, Milan, Tenn., have cast their vote in favor of more phosphate for pasture and hay crops, says T. R. Wingo, Gibson County agricultural agent. Here is how Mr. Pafford outlined the case to the county agent.

Last year Pafford had a four-acre field of lespedeza, one half of which received phosphate. When it was cut, the hay on the two plots was kept separate. He even stacked the bales separately in the barn.

As he fed the hay, Pafford put a bale from each plot in the feed lot. In every case, Pafford says, the livestock on his farm cleaned up every bite of the hay grown on phosphated land before they touched the hay from the non-phosphated two acres.

Fertilizer Aids Big Strawberry Yield

With a yield of 300 24-quart crates per acre of strawberries in one five-acre field, R. A. McUmber, of Greenfield, Tenn., has proved his contention that if the land is given proper care and the berries properly fertilized, cultivated and hoed, there is no reason for low yields. As told in *American Fruit Grower*, Mr. McUmber changed his farm during the depression from non-profitable cotton to fruit and berries. For the past several years his average yield on 25 to 30 acres in strawberries has been in the neighborhood of 200 crates per acre.

From the time plants are set in February or March until the patch is plowed up after

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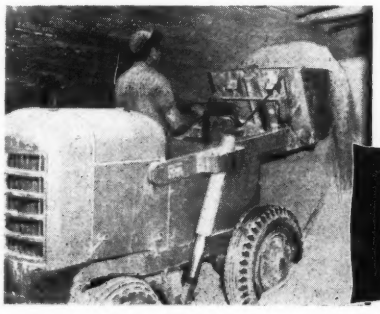

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Committee to Recommend Shipping Regulations on Ammonium Nitrate

Major General Philip B. Fleming, administrator of the Federal Works Agency, will appoint a five-man committee to conduct an exhaustive study into the hazards in the storage and handling of ammonium nitrate aboard ships. The appointment of the committee was authorized at a conference of representatives of the chemical industry, insurance underwriters and officials in Federal, state and local agencies held in Washington on September 8th by the President's Committee on Fire Prevention.

The sum and substance of the gathering was that, despite the fact that the explosive character of this form of fertilizer has been known for a quarter of a century, there was still much to learn of the cause and conditions under which the material explodes. However, it appears to be the general consensus that with proper handling, proper storage so as to be free from contamination with organic substances, and with due regard to fire regulations, the material can be shipped safely.

In a formal regulation adopted unanimously, the committee to be appointed was authorized to give immediate consideration to the question of ammonium nitrate shipments from ports other than isolated ports; to the question of shipments from one port to another; the problem of containers for the fertilizer, and to support continuous and enlarged research into the subject of the causes of combustion and its control. General Fleming is to name the group at an early date. All the latest information available on the safe handling of ammonium nitrate in transport is to be printed by the committee and distributed generally.

The committee will coordinate its activities with those of the inter-agency committee studying the ammonium nitrate problem, recently organized by Secretary of the Treasury Snyder and headed by Admiral Joseph F. Farley, Commandant of the Coast Guard, which is also undertaking independent research on the problem.

The session was opened by General Fleming calling attention to the need for studies to reduce the danger of combustion of ammonium nitrate aboard ship, without imposing controls that would hamper the rapid shipment of this plant food to the stricken areas of the world desperately in need of fertilizer.

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A Continuous Mixing Process for the Manufacture of Concentrated Superphosphate

A process for making concentrated or "triple" superphosphate by continuously mixing phosphate rock and phosphoric acid in a new type of mixer was described in a paper presented on September 17th, before the Fertilizer Division of the American Chemical Society at the Hotel Pennsylvania, New York City, by G. L. Bridger, R. A. Wilson, and R. B. Burt of the Tennessee Valley Authority, Wilson Dam, Alabama.

In the new process, strong phosphoric acid, made by the electric furnace smelting of phosphate rock, and finely pulverized phosphate rock are fed at automatically controlled rates into a funnel-shaped mixing bowl in such a way as to produce a whirlpool effect. The mixture is discharged from the bowl while still liquid onto a moving conveyor belt. After a few seconds it solidifies on the belt due to chemical reactions and is carried by mechanical conveyors to storage.

The process is based on the fact that when phosphate rock and strong phosphoric acid are mixed, a very fluid slurry is obtained for only a few seconds, after which the mixture becomes plastic and finally solid. In the batch-mixing process, used previously, it was not possbible to obtain thorough mixing and discharge the mixers while the mixture was still fluid. Consequently, the mixing operation was slower and required more equipment, power, and operators. In the new process it is possible to adjust conditions so that mixing is completed and the mixture discharged in the liquid state.

The new process is being used in TVA's Fertilizer Works at Wilson Dam to produce concentrated superphosphate at rates of 35 tons per hour and higher. A single small continuous-mixing unit has superseded two large batch-type mixers, and as a result there have been reductions in operating labor and power requirements. The initial cost of the new unit was considerably less than that of the older units. The superphosphate made by the new process is of better quality because more thorough mixing is accomplished.

Lockwood Answers Sabath

An investigation of the fertilizer industry, such as has been proposed by Rep. Sabath of Illinois, would show that fertilizer prices today are only 35 per cent above the 1935–39 average, as compared with an increase of more than 100 per cent in commodity prices generally, Maurice H. Lockwood, president of The National Fertilizer Association, stated recently.

"Government figures show that the increase in fertilizer prices over the pre-war level is substantially less than the increase in raw material and wage costs during the period," Mr. Lockwood said.

"Fertilizer is just about the cheapest commodity the farmer buys."

Monarch Mfg. Works Moves to New Plant

The Monarch Manufacturing Works, of Philadelphia, Pa., manufacturers of spray nozzles for acid chambers and other spray installations, is moving to a new and larger plant located at 2501 East Ontario St., Philadelphia 34, Pa. Operation of the new plant is expected to start about September 22nd.

Goals for 1948 Winter Cover Crop Seeds Announced

National goals calling for increased acreages of the principal winter cover crop seeds to be harvested in 1948 were announced on September 10th by the U. S. Department of Agriculture.

The 1948 goals (as compared with the 1947 acreages) call for a 48 per cent increase in the acreage of Austrian winter peas, a 30 per cent increase in crimson clover, a 39 per cent increase in hairy vetch, an 8 percent increase for common and Willamette vetch, and a decrease of 28 per cent for common rye grass. The goal for blue lupine is the same as this year's acreage.

Winter cover crop seed requirements are at a high level, a situation that is expected to continue for several years. The export market for these seeds has been considerably reduced but domestic use of cover crops is expanding. Agriculture Department officials say the use of these seeds should continue to increase so as to rehabilitate soils which have been heavily cropped during the last six years.

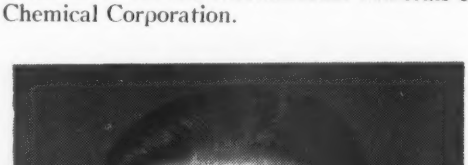
Following are the goal acreages for 1948 compared with indicated 1947 harvest acres:

	1948	1947
Austrian winter peas	74,000	50,000
Crimson clover	92,000	70,900
Hairy vetch	159,000	114,500
Common and Williamette vetch	90,000	83,500
Common rye grass	68000	94,000
Blue lupine	57,000	57,000

State goals for the 1948 crops will be announced following a determination of local possibilities by Federal and State agricultural agencies at State and county levels.

Taylor Joins American Potash Staff

American Potash & Chemical Corporation has just announced that Henry L. Taylor, Jr., has joined that company as of September 1st to become Manager of Midwestern Sales. Mr. Taylor will be located at the company's Chicago, Illinois, office, 231 South La Salle Street, Chicago 4, Illinois. He was formerly connected with the International Minerals & Chemical Corporation.



Henry L. Taylor, Jr.

FERTILIZER MATERIALS MARKET

NEW YORK

Materials Situation Still Extremely Tight. Increased Prices on Nitrogen Materials Reported. Feed Market More Active and Organics Increase in Price. Superphosphate Output at Top Peak with Further Increases Expected

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, September 15, 1947.

There is relatively little to report on developments during the last fortnight. Demand still continues greater than producers' estimated supplies. Materials plants are shipping to the limit of production and are about able to keep up with contract commitants without any chance of increasing allotments or advancing shipping schedules. The conference on ammonium nitrate shipping hazards did not attempt to reach any final conclusions on the subject but has arranged for further study of the problem. Meanwhile fertilizer manufacturers are taking all of this material that is available.

Sulphate of Ammonia

Prices have shown a tendency to reach a higher level, and now are running from $35.00 to $40.00 per ton, f. o. b. producing ovens. Quite a little of this material has been shipped on contracts at the $35.00 price but the increasing costs make it likely that later shipments will be at a higher range. Most schedules specify prices as current at time of each shipment.

Ammonium Nitrate

The price on Canadia ammonium nitrate has been increased to $62.75 per ton, f. o. b. works, in paper bags. The market is exceedingly tight on this material, both for home use and for export.

Organic Materials

The increasing demands of the feed have caused increases in most branches of the organic market. As high as $10.00 per unit of ammonia ($12.15 per unit N) is being asked for tankage. Dried blood has gone up 25 cents a unit, fish meal and scrap from $5 to $10 a ton.

Nitrate of Soda

Producers of domestic nitrate of soda have announced an increase of $5.00 per ton, effective October 1st. This brings the domestic material more on a line with the Chilean nitrate. The demand for nitrate of soda continues heavy, nevertheless, and producers and importers have no difficulty disposing of every available ton.

Superphosphate

With greater supplies of suphuric acid in sight, it looks as if supplies of superphosphate will continue to increase. One of the Ordnance acid works in Alabama is reported as being soon avaliable for fertilizer use which would add over 150,000 tons to the acid supply and permit the production of another 300,000 tons of superphosphate. Meanwhile, mixers are taking all available production as soon as it is in shape to ship.

Phosphate Rock

There has been no let-up in the demand for rock and the mining companies are shipping from current production. The output figures show that all records have been broken and, with new mining facilities coming into operation, the new fertilizer year should see even higher production.

Potash

The same condition of demand for exceeding production continues in the potash industry. Fertilizer producers have tried to increase their contract purchases but without success as the potash companies are sold up to their production limit. There have also been requests for advances in shipping dates, in anticipation of an earlier demand for mixed goods, but they are meeting with little success.

CHARLESTON

Record Tonnage of Mixed Fertilizer Expected. Organics Prices above Fertilizer Levels. Ammonium Nitrate Price Adanced in Canada

Exclusive Correspondence to "The American Fertilizer"

CHARLESTON, September 13, 1947.

All prime ingredients continue short of demand but in spite of this situation it is expected the production of complete mixtures of fertilizers will be greater than ever before for the coming season.

Organics.—Little change is noted in the market on organics. South American packing-house by-products continue at prices higher than most domestic buyers will pay. Some European nitrogenous is offered but at figures around $8.25 per unit of ammonia ($10.02 per unit N) with little interest shown by the buyers. Domestic nitrogenous ranges in price from $5.25 to $6.50 per unit of ammonia ($6.38 to $7.90 per unit N) in bulk, depending on production point. However, offers for domestic nitrogenous are lacking in the market.

Castor Pomace.—Production is reported at low levels with prices firm and unchanged. Movement is against contract commitments.

Potash.—Nothing additional is being offered and demand continues far in excess of the supply.

Nitrate of Soda.—There remains a spread between prices for domestic and Chilean nitrate of soda but it is expected that domestic producers will eventually fall in line with the price of Chilean nitrate of soda.

Ammonium Nitrate.—Prices on Canadian material have advanced by about $8.25 per ton and the present market is around $62.75 per ton in paper bags, f. o. b. plant. It is reported that relatively little nitrate is being shipped abroad at the present time by the Government.

Dried Ground Blood.—Chicago price is around $7.50 to $8.00 ($9.12 to $9.72 per unit N) with little interest shown by fertilizer manufacturers at the higher level.

Bone Meal.—Some buying interest has been indicated by the fertilizer trade, but the price remains unchanged.

Superphosphate.—This material is particularly scarce in the southeast and demand continues strong.

Phosphate Rock.—The movement of phosphate rock continues curtailed by a shortage of box cars used in the movement of grain to the ports. The market is firm and demand is strong.

PHILADELPHIA

Demand for Future Delivery Greater Than Probable Production. Feed Demand Keeps Organic Prices High

Exclusive Correspondence to "The American Fertilizer"

PHILADELPHIA, September 15, 1947.

Interest in raw materials for future delivery continues quite active. Demand is principally for the basic chemicals, and while productions are well under contract, buyers would like to hasten shipment and also increase the quantities. Organics are in limited supply, and increased demand by stock food manufacturers keeps the prices too high for fertilizer use.

Sulphate of Ammonia.—Demand continues active and ahead of production, with price range from $35.00 to over $40.00 per ton in bulk. Most contracts are said to provide for fluctuation.

Nitrate of Soda.—Market is firm with interest mostly in future shipments.

Nitrate of Ammonia.—There is very active demand for this article, with supply insufficient to meet requirements. New shipping and handling regulations are presently under consideration.

Castor Pomace.—Production is said to be running low, with no first hand offerings reported.

Blood, Tankage, Bone.—Demand from the feeding trade is sufficiently active to keep these organics out of the fertilizer field. Blood has been offered at $7.50 to $8.00 per unit of ammonia ($9.12 to $9.72 per unit N), with tankage at $8.50 to $8.75 ($10.33 to $10.63 per unit N). Bone meal seems to be in better supply, with prices ranging from $52.50 to $65.00, according to quality.

Fish Scrap.—Fairly active interest. Scrap has been quoted at $120.00 and meal at $134.00 per ton for 60 per cent protein grade —all feeding business.

Phosphate Rock.—Production is moving on contracts, and the supply position is exceedingly tight. It is thought the output will be increased in the near future.

Superphosphate.—The demand continues strong, and while the production has increased, movement is principally on contracts. Producers show no eagerness to make further sales at present.

Potash.—Demand is very strong with shipments moving out of production. The requirements are now far ahead of the supply capacity.

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CHICAGO

Fertilizer Organics Sold up into Fall. Feed Feed Tankage Price Increased

Exclusive Correspondence to "The American Fertilizer"

CHICAGO, September 13, 1947.

Offerings of mid-west organic fertilizer material are still lacking, sellers maintaining to be well sold for late fall deliveries. Some inquiry from buyers has again been manifested.

It is reported some of the large producers have advanced 60 per cent protein digester tankage up to $130.50 a ton. Demand apparently is greatly in excess of supplies, particularly for digester tankage, which latter is being sought by hog feeders.

Chase Bag Plant Receives Safety Award

In recognition of an outstanding safety record, the Liberty Mutual Insurance Company awarded the Dallas Branch of the Chase Bag Company a Certificate of Merit for safety achievements.

At a general meeting of all plant personnel, Castle Hopper, Plant Superintendent, accepted the award on behalf of the employees who accomplished nearly one quarter million man hours without an accident.

A. C. Ogden, Manager, expressed the company's appreciation to the employees for their accomplishment during the Chase Bag Company's Centennial year.

Sulphate of Ammonia During July

There was little change in by-product sulphate of ammonia production during July, according to the U. S. Bureau of Mines. The output of 66,018 tons was slightly less than that of June. Shipments increased slightly, while stocks on hand at the end of the month were only 26,229 tons. Until new coke ovens and recovery plants can come into production, the output will probably remain at this level.

	By-Product	
	Sulphate of Ammonia Tons	Ammonia Liquor Tons (NH_3)
Production		
July, 1947	66,018	2,382
June, 1947	66,168	2,263
July, 1946	64,864	2,158
Jan.-July, 1947	461,856	16,335
Jan.-July, 1946	331,359	13,546
Shipments		
July, 1947	62,050	2,326
June, 1947	61,917	2,260
July, 1946	42,766	1,855
Stocks on hand		
July 31, 1947	26,229	610
June 30, 1947	22,417	709
July 31, 1946	47,194	823

The U. S. Bureau of Census reports production of 18,397 tons of synthetic sulphate of ammonia, technical grade, during July. The output of synthetic anhydrous ammonia during July was 93,345 tons, while ammonia nitrate solutions totaled 87,253 tons.

Sugar Cane Responds to Complete Fertilizer

The old adage about "the more you put into something the more you get out of it" seems to apply to raising cane—that is, sugar cane. Complete mixed fertilizer gave better returns in Louisiana tests than applications of nitrogen alone.

The best adapted treatment in last summer's tests was a combination of 60 pounds of nitrogen with adequate quantities of phosphorus (P_2O_5) and potash (K_2O). This was the highest rate of nitrogen used in the tests.

Top increase in yield was obtained on a plot which received 60 pounds of nitrogen and 40 pounds of phosphorus. But in over-all yields,

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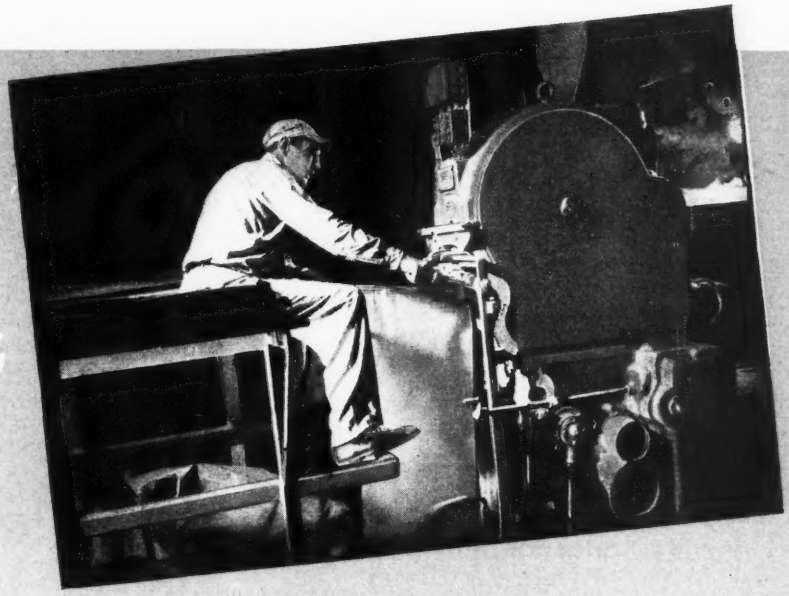

On a straight run of a single grade of fertilizer, an output as high as 36 tons per hour is common with a St. Regis 160-FB packer. Only *one operator* is required. The packer automatically fills and weighs the self-closing multiwall paper valve bags.

There are many other time- and cost-saving advantages. Plant workers like Multiwalls because they are easy to handle, clean and sift-proof. Customers and dealers like Multiwalls because special bag construction protects fertilizer against "caking" due to moisture-vapor penetration, and because they are clean and easy to handle.

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the combination of the three elements gave best responses.

Levels of nitrogen used in the experiment ranged from 40 to 60 pounds, phosphorus (P_2O_5) from 25 to 60 pounds, and potash (K_2O) from 40 to 60 pounds. The combination which gave best results in the tests was 60 pounds of nitrogen, 25 pounds of phosphorus (P_2O_5), and 40 pounds of potash (K_2O).

The increase in yield from the combination of these amounts of plant food was 1,530 pounds of sugar per acre. The growing season was very wet and both plant and stubble cane responded profitably to nitrogen at the 60 pound per acre level.

In 1945, results from similar tests showed that the highest yields of sugar were obtained on the average from 60 pounds of nitrogen, 40 pounds of phosphorus (P_2O_5) and 60 pounds of potash (K_2O) per acre.

Last summer's tests were conducted by R. K. Walker and M. B. Sturgis of the Louisiana Experiment Station.

Recommendations for Georgia Grain Fertilizers

"Farmers who plant small grain should check up now on the availability of nitrogen for spring topdressing," urges J. G. Futral, associate agronomist at the Georgia Experiment Station.

The Station's general recommendation for grain is to apply all of the phosphate and potash in the fall at planting. Part of the nitrogen may be applied in the fall and the remainder in the spring, or all of it may be applied in the spring.

"Last year many farmers were unable to obtain nitrogen for spring topdressing," Mr. Futral says, "and this situation seems likely to occur again in 1948."

In order to cut down on the amounts of spring nitrogen needed, he suggests a complete fertilizer should be applied in the fall to furnish part of the nitrogen needed. Then smaller amounts of nitrogen than would normally be used may be applied in the spring.

Expressed as pounds of plant food, Mr. Futral recommends that grain should receive 32 pounds per acre of phosphate and 24 pounds per acre of potash. Oats and barley should receive a total of 32 pounds of nitrogen and wheat up to 48 pounds of nitrogen per acre. These amounts may be obtained by using 400 pounds per acre of a 4–8–6 fertilizer in the fall followed by a spring topdressing of 50 to 100 pounds per acre of any of the usual sources of nitrogen.

"If no nitrogen is available in the spring," Mr. Futral points out, "use a topdressing of 200 pounds per acre of complete fertilizer, preferably one containing at least six per cent nitrogen."

Cows Know Their Phosphates

Livestock on the farm of J. C. Pafford, Milan, Tenn., have cast their vote in favor of more phosphate for pasture and hay crops, says T. R. Wingo, Gibson County agricultural agent. Here is how Mr. Pafford outlined the case to the county agent.

Last year Pafford had a four-acre field of lespedeza, one half of which received phosphate. When it was cut, the hay on the two plots was kept separate. He even stacked the bales separately in the barn.

As he fed the hay, Pafford put a bale from each plot in the feed lot. In every case, Pafford says, the livestock on his farm cleaned up every bite of the hay grown on phosphated land before they touched the hay from the non-phosphated two acres.

Fertilizer Aids Big Strawberry Yield

With a yield of 300 24-quart crates per acre of strawberries in one five-acre field, R. A. McUmber, of Greenfield, Tenn., has proved his contention that if the land is given proper care and the berries properly fertilized, cultivated and hoed, there is no reason for low yields. As told in *American Fruit Grower*, Mr. McUmber changed his farm during the depression from non-profitable cotton to fruit and berries. For the past several years his average yield on 25 to 30 acres in strawberries has been in the neighborhood of 200 crates per acre.

From the time plants are set in February or March until the patch is plowed up after

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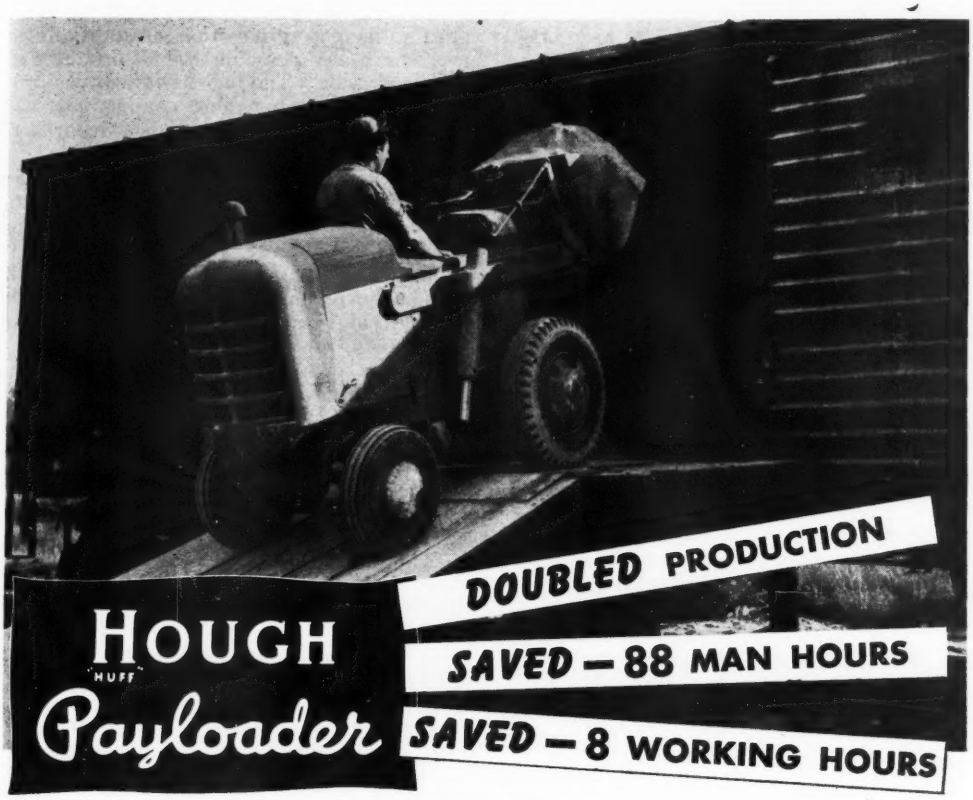

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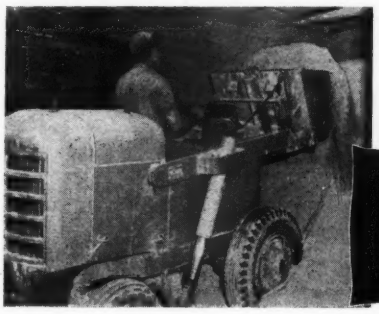

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three or four years, cultivation and hand hoeing are continuous in order to keep down weeds. All setting is done on ridges about 10 inches high. Fertilizer used depends somewhat on the weather. Ordinarily from 300 to 500 pounds of a 4–8–8 fertilizer are applied per acre each spring just after growth begins. However, if moisture is high and rains abundant, nitrogen must be reduced or even eliminated.

This spring Mr. McUmber applied 300 pounds of 0–12–12 per acre and it turned out to be just about the best he could have done. If too much nitrogen is applied, especially when rains are plentiful, production is lowered because of excessive leaf growth. It also leads to softening and spoiling of berries. Fertilizer is applied by hand and is thrown directly on the plants. Following the fertilizer application, men with small brooms brush the fertilizer off the leaves.

International Reports Profitable Year

International Minerals & Chemical Corporation reported net earnings of $3,826,992 after all charges for the fiscal year ended June 30, 1947, as compared with $2,925,657 for the previous fiscal year in its 38th annual report recently released to stockholders.

Earnings per common share for the year were $4.35 on the 788,155 shares outstanding, as compared with $3.92 per share last year on the 646,346 shares then outstanding.

Net sales amounted to $41,302,250 showing an increase of 20 per cent over sales of $34,373-106 last year, and an increase of 36 per cent over sales of $30,301,091 for the fiscal year ended June 30, 1945.

"Not only have sales and earnings again exceeded all previous records," Louis Ware, president of the company, said, "but it is encouraging to note how well they reflect the policy of greater diversification and expansion upon which the corporation embarked some years ago.

"All divisions are constantly applying every effort to increase production substantially to meet the heavy demands for all products of the corporation. The increased facilities provided last year plus those coming into use this year should permit greater output and improved service to our customers.

"Additions to fixed assets during the year included the completion of the amino products plant at San Jose, California; the Achan phosphate mine near Mulberry, Florida; a sulphuric acid plant at Spartanburg, South Carolina; a fertilizer mixing plant at Pensacola, Florida; and an acidulating plant at Mason City, Iowa.

"Cash received during the year from the sales of common stock amounted to $4,049,330 of which $142,106 was from 17,490 shares issued on exchange of stock purchase warrants, $3,955,055 from 121,694 shares issued on subscription rights, and $93,188 from sales of 2,625 shares to officers and employees, less expenses of $141,019.

"The plant food division again completed a record year of satisfactory business even though fertilizer materials still continue short of requirements. Sulphuric acid for manufacturing superphosphate and chemicals is needed to overcome the greater part of the material shortage. The corporation, therefore, is building two sulphuric acid plants, one located at Spartanburg, South Carolina, which will commence operation this month, and one at Lockland, Ohio, which is expected to commence operation about next January.

"A new mixing plant at Pensacola, Florida, has been completed and will be in full operation during the coming year. The acidulating plant for manufacturing superphosphate at Mason City, Iowa, is now completed and in operation. This plant will enable the corporation to increase its tonnages of mixed goods

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and superphosphate in the states of Iowa, Minnesota, and Wisconsin.

"With the continued shortage of food and agricultural products and the continuance of the soil conservation program by the U. S. Department of Agriculture, the heavy demand for fertilizer and superphosphate will continue and, if raw materials continue to be available, it is expected all plants will operate at capacity during the coming year.

"Fertilizer prices still remain relatively low as compared with prices of other commodities and unusually low in comparison with prices of farm products. With the increased cost of raw materials, labor, and freight, it will probably be necessary to increase fertilizer prices to offset part of these increased costs.

"Increased labor and material costs again were important factors in the potash operations. Increased sales of about 15 per cent over the preceding year, together with benefits of technical improvements in process, aided in offsetting these increased costs. For the tenth successive year, potash selling prices remained at pre-war levels.

"New records of production, sales, and earnings featured operations of the phosphate division during the past year. In Florida, the Peace Valley mine continued its outstanding production of high grade phosphates. The Peace Valley mine produced in excess of one million gross tons during the year—twice its original designed capacity and a record production for an individual ore mine in the domestic phosphate industry. Achan—a modern, standard grade mine—was successfully brought into operation a year ago and has been further enlarged. Construction continued at the new Noralyn mine which should be in operation next January and add substantially to the output of high grade phosphates.

"Demand for phosphates continues in excess of supply. Foreign demands during the year permitted re-establishment of a profitable pre-war export trade which will be expanded when tonnage is available from the Noralyn mine. A wholly owned English subsidiary—International Minerals & Chemical, Ltd.—has been organized with headquarters in London to promote European sales."

ANHYDROUS AMMONIA

(Continued from page 11)

It has long been known that young cotton and corn grow off faster when fertilized with nitrogen in the form of ammonia rather than in the form of nitrate. Older plants prefer nitrate nitrogen. Anhydrous ammonia helps both ways. Applied before planting it furnishes ammonia nitrogen for the young plants. Gradually it changes to the nitrate form. By that time the plants are old enough to have a preference for nitrates.

What's the future of this method of fertilizing crops? On the basis of this year's costs the future looks bright. Nitrogen in anhydrous ammonia in this area costs six cents per pound, in ammonium nitrate ten cents, and in other fertilizers even more. What the relative prices will be another year no one knows. While the cost of equipment for transporting and applying anhydrous must be reckoned with, it seems that the actual operating cost in applying it must be pretty low. With present equipment, the Mississippi station says that one man and a tractor can apply anhydrous ammonia to about twice as many acres in a day as two men and a tractor can apply the solids.

In connection with the sale of anhydrous ammonia for use as a fertilizer the manufacturers have some problems. Most nitrogen is applied in a very short season. It would take huge tanks to store up very much of a supply. Can they keep running the year round by converting anhydrous into nitrates or other products in off seasons? In order to serve a community high pressure storage tanks must be provided at the trading center. Will the manufacturers provide these or will local dealers come into the picture?

The product now used in this new way is being manufactured in wartime synthetic nitrogen plants now in private operation. Many problems of use and of distribution are yet to be worked out. Most remarkable progress has already been made. In its application it shows promise of fitting in admirably with newly developed plans for complete mechanical production of cotton.

At a public demonstration on May 29th at the Delta Station, Stoneville, Miss., 500

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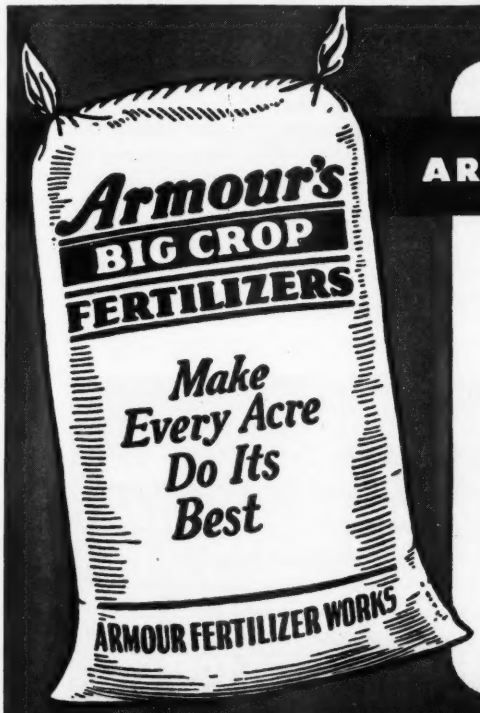

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people from four states watched a tractor mounted machine sidedress two rows of cotton at a time while rotary hoes mounted in front cleaned the rows of small grass and small sweeps cleaned the middles. The ammonia was put down about six inches deep at a distance of about five or six inches from the cotton.

Some wanted to know how the gas is made to stay in the ground. Does any of the gas escape? Well, you know how strong the odor of ammonia is. If any of it was escaping, you could surely smell it by getting your nose to the ground. We'll have to admit we couldn't get our nose close enough to the ground to smell it.

July Superphosphate

The figures of the U. S. Bureau of Census show that total superphosphate production, figured on the basis of 18 per cent A. P. A., was infinitesimally smaller than the June output; 801,835 tons in July and 802,128 tons in June. There was an increase of 18 per cent, however, over the July, 1946 figure of 679,777 tons.

Normal superphosphate showed a drop of about 9,000 tons from June, but concentrated was 3,000 tons greater and was almost 50 per cent greater than July, 1946. Stocks on hand at the end of the month were somewhat greater than on June 30th.

	Normal	Concentrated	Base Goods
Production	18% APA	45% APA	18% APA
July, 1947	712,600	33,810	4,710
June, 1947	721,562	30,698	3,821
July, 1946	618,995	23,026	3,217
Shipments and Used in Producing Plants			
July, 1947	677,388	33,222	2,171
June, 1947	570,431	29,794	3,190
July, 1946	555,472	23,787	641
Stocks on Hand			
July 31, 1947	749,473	59,021	6,354
June 30, 1947	705,454	58,433	3,815
July 31, 1947	623,348	45,067	4,837

Fertilizer for Indiana Wheat

Purdue University agronomists recommend applications of 300 to 350 pounds of 3–12–12 fertilizer for wheat on practically all upland silt or clay loam soils and for sandy loams. If the 3–12–12 cannot be obtained, then 2–12–6 is a good substitute for the wheat crop itself. The additional potash is especially important for the clover and corn crops following the small grain.

THE ATOM GOES TO WORK FOR THE FARMER

(Continued from page 10)

The word molecule was used above. A molecule is a chemical entity composed of different atoms. The atoms of a molecule can be interchanged. That is what happens in chemical reactions all the time. That is why it is possible to introduce an isotope into a molecule without altering the chemical behavior of that molecule.

Radiocalcium or radiophosphorus atoms can be introduced into calcium phosphate molecules and fed to an animal. With the counter, it is possible to trace in the animal and calculate the proportion of this particular feed which eventually appears in the bone tissues; determine the time it takes to get there, trace the intermediate steps it went through to get there and then learn what eventually becomes of it. This new technique now enables us, for the first time, to get an accurate picture of the way a body or plant absorbs, utilizes, and excretes various calcium or phosphorus compounds.

Effect of Radioactive Phosphorus on Plant Growth

One of the first questions to be asked in working with radioactive isotopes is: what effect does the radiation have on the normal processes of plant growth? Are we sure the radiation does not adversely affect these processes and vitiate the test?

That is a fair question. At the very outset of the studies at Beltsville, the scientists set up experiments to test this out. Three different quantities of radiophosphorus were used in three different soil types. The radiophosphorus element was introduced into three different phosphatic fertilizer materials. Rye grass was the crop. The range in amounts of the radiophosphorus used was on an equivalent per-acre basis and was calculated

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so as to cover any possible dosage that might be applied in subsequent experiments.

The rye grown with the radiophosphorus fertilizer showed no perceptil le differences from the check. The relative amount of radioisotope that could at any time be absorbed is so exceedingly small, that it is safe to conclude no adverse effects can be experienced.

Other Experiments

Mention has already been made of the study of phosphorus up-take by the potato crop on soils having high amounts of available phosphorus.

In this greenhouse study, two Portsmouth soils were selected, one having 300 pounds and the other 800 pounds of available P_2O_5 to the acre. The phosphate was applied on limed soil in bands and in direct contact with the seed piece. Four gallon pots were used and the superphosphate was applied at the per acre rate of 100 pounds of P_2O_5 and the lime at 1,500 pounds. A single seed piece was planted in each pot.

A complete harvest was made after 80 days and at that time samples of tops and ubers were prepared for analysis. The percentage of phosphorus absorbed from the fertilizer was determined on all samples. The results are graphically summarized in Fig. 3.

Field tests are under way to check the greenhouse results. These tests are being conducted in Maine and in North Carolina. The objectives of these tests are to find out what influence is exerted on the final crop result by each of the following factors: soil type, soil phosphorus, crop species or variety, method of placing the fertilizer, rates of P_2O_5 applications, and liming. The tests will be repeated over a period of years.

Radio-autograph

Radioactivity was first discovered accidentally through its effect upon a photographic plate. Fig. 4 is an application of this very same principle. Leaves or other parts of a plant containing radioactive phosphorus are pressed against a photographic film enclosed in a light-tight paper envelope for a certain length of time. The penetrating rays from the radiophosphorus produced the developed contact image as shown. We see clearly how the radiophosphorus has distributed and concentrated itself in the various tissues of the plant. An application of

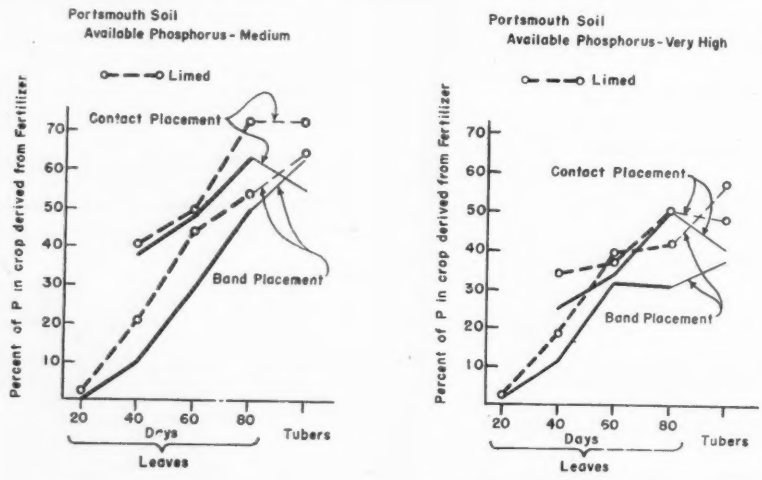

Fig. 3. Effect of placement, liming and phosphorous fertility of soils on the utilization of superphosphate by potatoes
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this principle undoubtedly will help to improve the technique of plant-tissue analysis.

What's Ahead?

The work with radioisotopes has only just begun, but the positive results already obtained whet the appetite for more and stir the imagination regarding more practical applications of the radioactive tracer technique to agricultural problems.

Fig. 4. Radio-autograph of a field-grown tobacco plant which had received radioactive superphosphate

Prepared by U. S. D. A. Bur. Plant Industry, Div. Fert. Soils and Irrigation

We hope that this research eventually will give us satisfying answers to the many problems of economic fertilization, not only with phosphorus, but also with all the other elements. An industry that supplies the country annually with upward of 8 million tons of phosphatic fertilizer and 15 million tons of commercial fertilizer should want to know more about the fundamentals involved in the efficient use of its products.

How can we accurately diagnose the need for P_2O_5? How much P_2O_5 to apply on each soil type? What is the most economical method for applying P_2O_5? What is the most suitable chemical form of phosphate to apply at any given location? What is the subsequent fate of the applied P_2O_5 in the soil, in the plant? What is the true function of P in the plant, in the animal, in the human physiology? How do plants absorb P_2O_5, that is, what is the mechanism or what actually happens at that microscopic point between root hair and soil which determines the uptake of phosphorus?

These are only a sample of the many questions to which we now have no entirely satisfactory answer.

Will the new tracer technique furnish the answer? We do not know, but it is the only technique so far developed which provides the most promising tool with which to get the answers.

Fertilizers for Texas Blacklands

For decades, farmers in the Blacklands of Texas have been saying "it can't be done" when a question came up about using commercial fertilizers. But M. H. Brown, Jr., Limestone County Agricultural Agent, says that some of them, at least, are beginning to change their minds.

On a recent visit to the Temple Blackland Substation of the Texas A. and M. College Agricultural Experiment Station, 23 Limestone County farmers, businessmen, and agricultural workers were "astounded," says Brown, to find corn green and making grain after five weeks without rain. Corn and small grains are being topdressed with nitrogen in experimental work at the substation. The farmers were also surprised at the productive capacity of blackland when measured in pounds of beef per acre where the soil improvement work is going on.

The phosphate and sweet clover combination, says Brown, is now offering the blackland farmer a chance to improve his soils, since the weather is not such a limiting factor when plant food and humus—put in with fertilizers and legumes—is plentiful.

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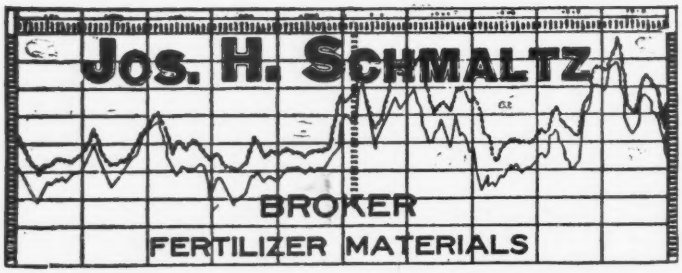

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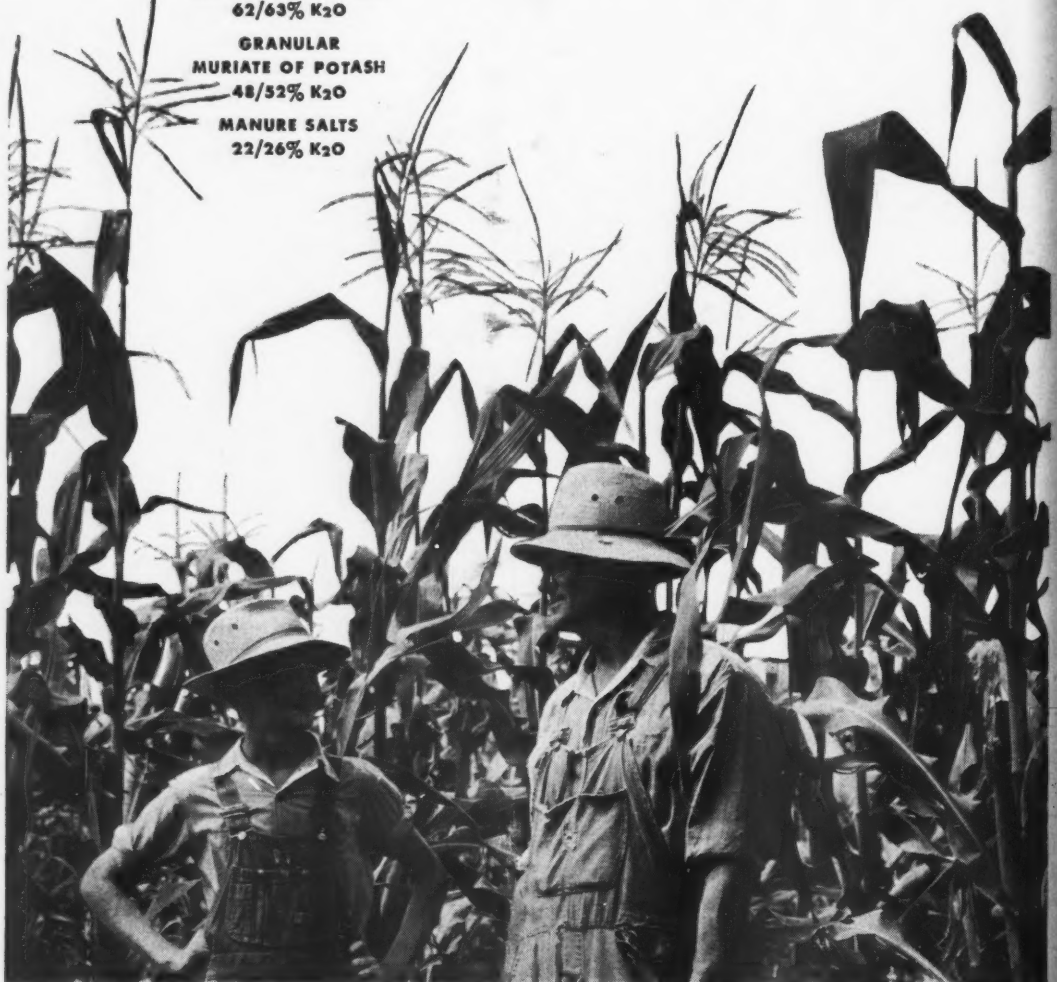

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